

TGE Marine cooperates with Northern Lights JV to ensure safe and efficient transport of CO₂



Picture: First-of-their-kind CO₂ carriers: facilitating the first European full-scale CCS value chain

The Northern Lights Joint Venture (JV) represents a pivotal advancement in carbon capture and storage (CCS) technology.

Established by Equinor, Shell, and TotalEnergies the Northern Lights Joint Venture (JV) is an initiative, not only for the energy sector but also for the future of the marine industry. By spearheading the development of the world's first open-source infrastructure for transporting and storing CO₂, Northern Lights is helping to reshape how industries around the world approach carbon capture and storage (CCS) and, crucially, how the maritime sector can contribute to decarbonisation by providing a comprehensive solution for transporting and storing CO₂.

Central to the Northern Lights initiative, is the development of a fleet of specialised liquefied CO₂ (LCO₂) carriers designed to transport CO₂ from capture sites to storage facilities. The first of these vessels, the Northern Pioneer, was delivered in November 2024, with the Northern Pathfinder following in December 2024. Both vessels were constructed by Dalian Shipbuilding Industry Co. (DSIC) in China. Further two vessels are in

the building stage at the time this article was written at the Dalian Shipbuilding Offshore Company (DSOC)

Purpose built vessels

Integral to the functionality of these LCO₂ carriers is the cargo handling system, which ensures the safe and efficient transfer of CO₂. TGE Marine has been instrumental in developing these systems for Northern Lights JV.

Their technical proficiency and adaptability have ensured the creation of fit-for-purpose procedures, supporting the rapid development of the CCS business. Conner Love, Maritime Manager at Northern Lights, acknowledged TGE Marine's role, stating: *"TGE Marine have been instrumental in the development of the world's first large capacity LCO₂ carriers for Northern Lights JV."*

Before vessels are delivered, they conclude sea and gas trials, in which all the equipment is checked for functionality and any adjustments can be made prior to the delivery of the vessel. The further two vessels have had some minor changes to the systems from the first two vessels. These types of improvements are common when a series of vessels has been ordered at the same time as changes required may come afloat after the vessels become operational.

The third and fourth vessel are equipped with additional equipment on the cargo vapouriser side, making them more versatile for trading in cold-water trades. Furthermore, the vessels received some improvements, that increase overall cargo operation efficiency.

Future proofing your investment by commissioning a study

Vessel building projects often take years to finish, and the process starts with a design which then will go through approval processes with classification societies to gain an *Approval in Principle* to ensure the safety and sustainability of the design. TGE Marine has been part of many vessels design processes and is the frontrunner in carrying out studies for CO₂ carriers among others.

TGE Marine often work with vessel designers through studies, which generally allow for Approvals in Principle (AiP's) to be granted more efficiently by classification societies. The studies indicate that if a vessel is designed with [for example] TGE equipment on board as indicated by a study, the vessel will be compliant with regulatory frameworks. With these specific vessel designs, TGE Marine implemented a Front-End Engineering Design (FEED Study), which allows the parties involved to establish the requirements for the vessel as well as possible constraints. It did also establish the design and configuration of TGE Marine systems, such as the cargo handling system for these vessels. All studies allow for the assessment of risks and the evaluation of multiple concepts to align with regulations as well as ensure that costs and timelines can be estimated reliably.

Redefining the Scope of Carbon Capture

At its core, Northern Lights JV aims to provide an essential solution to the challenges of reducing industrial CO₂ emissions by creating an infrastructure that allows for the safe and efficient transport of CO₂ from capture sites to permanent storage facilities, the organisation is opening the door for wider industrial adoption of CCS, especially in sectors that have struggled to find cost-effective decarbonization methods. The ability to capture CO₂ at a source—whether from power plants, industrial processes, or other sources and then transport it to storage facilities and locations will significantly reduce emissions that would otherwise be impossible to eliminate.

What makes the Northern Lights JV unique, is its focus on scalability and commercial viability. By establishing open-access infrastructure, Northern Lights enables a broad spectrum of industries—including marine shipping, oil and gas, and heavy industries—to use the same network for carbon storage. This network could set the standard for global CCS systems, making it easier for companies worldwide to integrate CCS into their operations. The open-access model provides flexibility, reduces costs, and incentivises more businesses to invest in decarbonisation technologies.

The collaboration between Northern Lights JV, TGE Marine, and the shipyards demonstrates a successful partnership, not only in building vessels but also in advancing CCS technology. Through these concerted efforts, Northern Lights JV is on able to offer viable commercial CO₂ transport and storage services, contributing significantly to global emission reduction goals.

At the end of March 2025, the joint venture publicly announced the start of Northern Lights Phase 2 expansion, in which the capacity will be extended to ~5Mtpa. This would mean a more than 3-fold increase compared to phase 1, which dealt with 1,5Mtpa of LCO₂. To allow for the adaptation of the increased capacity, a new fleet of dedicated LCO₂ carriers will be required to meet the demand.

Boosting Technological Innovation

With the involvement of companies like TGE Marine, the Northern Lights JV is driving the development of cutting-edge technologies that will directly benefit the marine industry. These innovations are designed to make the process of CO₂ storage and transport more efficient, safer, and cost-effective. The marine CCS infrastructure enabled by Northern Lights JV will encourage wider adoption of low-carbon technologies such as alternative fuels and energy-efficient systems across the shipping fleet.

TGE Marine is working closely with Northern Lights JV and other parties to ensure that the efforts to decarbonise can be adapted to an increasing number of organisations and a variety of parties in the process to comply with the new regulations and guidelines set in place by the International Maritime Organisation and MEPC83

TGE Marine's innovative cargo handling system design solves a pressing challenge in today LCO₂ infrastructure. "Many infrastructure projects such as Northern Lights rely on an in-flux of LCO₂ from a variety of emitters. In these scenarios, vapor return, so the exchange of cargo vapor alongside liquid during loading and unloading operations, has the drawback of inducing cross-contamination between different LCO₂ compositions originating from different emitters (and thus sequestration from different chemical/industrial processes.": explains Florian Krauss, TGE Marine's Design Engineer who has been working on the Northern Lights vessel project since the conception of the project.

A New Standard for Global Decarbonisation Efforts

The marine industry is one of the most challenging sectors to decarbonise due to its reliance on fossil fuels and the technical difficulties of reducing emissions from large, heavy vessels. However, Northern Lights JV offers a concrete pathway for addressing

these challenges by providing a scalable solution for the transportation of CO₂ from ship emissions to offshore storage sites.

As the world shifts towards a low-carbon future, a robust CCS infrastructure will be crucial in meeting international climate goals, such as the Paris Agreement targets as well as the newly agreed tariffs by the International Maritime Organisation in April 2025. The ability to transport and store captured CO₂ at scale, as demonstrated by Northern Lights JV, offers a practical and scalable solution that could be replicated globally, helping to decarbonise industries that are otherwise difficult to electrify or transition away from fossil fuels.

Furthermore, Northern Lights JV is creating a model for collaboration between governments, industries, and businesses. By supporting an open-access infrastructure, the project fosters cooperation rather than competition, which is essential for achieving the collective goals of global decarbonisation.

As the shipping industry looks for viable decarbonisation strategies, the successful implementation of CCS through Northern Lights JV will serve as a blueprint for a sustainable future, paving the way for the broader adoption of green technologies and contributing to global efforts in combating climate change.

The integration of advanced technologies and infrastructure, such as the LCO₂ carriers with TGE Marine equipment on board, will play a key role in making this vision a reality. The Northern Lights JV is more than just a carbon capture and storage project—it's a critical catalyst for the decarbonisation of the marine industry and beyond. The project represents a pioneering step toward the realization of an integrated, global CCS network, providing a clear path for the maritime sector to reduce its emissions.

Introduction: TGE Marine Gas Engineering GmbH (TGE Marine)

TGE Marine

THE GAS EXPERTS – Innovations for Greener Shipping

45+

years of experience

250+

gas tankers

400+

cargo and fuel gas
tanks

100+

fuel gas systems

1

crew

Since 1980 TGE Marine is the leading liquefied gas systems' provider for

- LNG/LEG/LPG/NH₃ Gas Carrier
- Bunker Vessels for cryogenic gases
- Fuel Gas Systems (LNG, Ethane, LPG, NH₃ and future fuels)
- Ammonia (NH₃)
- CO₂
- Floating Units

With our passion for innovation. We are supporting the industry with technical solutions for a sustainable future.

For media please contact:

TGE Marine Gas Engineering GmbH

Nabiha Sghaier

Phone: +49 228 50218 115

Email: nabiha.sghaier@tge-marine.com

&

Riikka Cosgrave

+49 228 50218 656

freelancer.cosgrave@tge-marine.com

Website: www.tge-marine.com

LinkedIn: <https://www.linkedin.com/company/tge-marine>

YouTube: www.youtube.com/@TGEMarine